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*Neue Versuchungen an den Ohrenbogengängen.* J. BREUER. Pflüger's Archiv, Bd. XLIV, p. 135, 1888.

Any doubt which may have remained among physiologists as to the effect of the semicircular canals upon the sense of direction must be completely set at rest by these admirable experiments of Breuer. The one thing which remained to be done—the separate excitation of the three canals by the electric current, and the production of the corresponding motions of the head under circumstances which excluded the possibility of any accompanying injury to the brain—has now been successfully accomplished. These experiments are, of course, very much superior in delicacy and conclusiveness to those in which the semicircular canals are cut. As little as possible of the ampullae is exposed, and the dove is kept in a state of stupor sufficient to prevent spontaneous motions. The strongest reactions—motions of the head through an angle of forty-five degrees—are got by the application of heat and cold. As Breuer showed in a former paper (1875), the motion, in the plane of a given canal, is in a different direction according as one end or the other of its ampulla is excited. When the electric current is used, the direction of motion changes with the direction of the current, and with the intermittent current no motion at all is obtained. The head of the dove may thus be made to move at pleasure in any one of six different ways, two in each of the three planes of the semicircular canals. That the current does not act directly upon the brain is proved in the following way: the point of the gold-tipped needle which forms the cathode is first inserted into the brain near the ear, and then the strength of the current is diminished until motion is no longer obtained in this way. The needle is then applied to the canals, and the same strength of current is here found to be sufficient to produce a marked reaction. It is not, of course, shown that the cerebellum is not concerned in the motion, but that the canals are the peripheral sense-organ for the centers in the cerebellum. Breuer's former experiments in mechanical stimulation of the canals he has repeated and confirmed. Motion of the head can be made to take place in one direction or the other according to the end of the canal from which the endolymph is sucked out by a scrap of blotting-paper; the direction of the motion is the same as that of the endolymph-stream.

It would seem that a more important rôle ought to be attributed to the semicircular canals in the derivation of the space-feeling than is usually done. It may also be conjectured that a fourth dimension in space will remain forever inconceivable to us until after we have developed a fourth semicircular canal. C. L. F.

*Die Abhängigkeit zwischen Reiz und Empfindung.* Dr. JULIUS MERKEL. Philosophische Studien, IV, 4, pp. 541-596, and V, 2, pp. 245-292.

This elaborate paper recounts, with a mass of unnecessary details and a bewildering abundance of confusing tables, a series of experiments designed with great care, carried out with infinite patience, and directed to the solution of the most important problem of psychophysics. It would be impossible to notice here all the many points touched upon in this comprehensive study; only the conclusions reached, the methods used, and the inferences drawn from the results can be summarized. Ordinary observation would call